REMARKS/ARGUMENTS

Claims 1-22, 26-28, and 40-49 are pending in the application. The Applicant hereby requests further examination and reconsideration of the application in view of these remarks/arguments.

On page 2, the Examiner rejected claims 1, 3, 6, 8-10, 19-21, 26, 28, 40, 42, 45, and 47 under 35 U.S.C. § 102(b) as being anticipated by Roeder. On page 5, the Examiner rejected claims 12-18, 43, 46, and 48 under 35 U.S.C. § 102(b) as being anticipated by Roeder or, in the alternative, under 35 U.S.C. § 103(a) as being obvious over Roeder. On page 8, the Examiner rejected claims 4, 5, 7, 44, and 49 under 35 U.S.C. § 103(a) as being unpatentable over Roeder in view of Hearle (as presented by Zhang). On page 9, the Examiner rejected claim 22 under 35 U.S.C. § 103(a) as being unpatentable over Roeder. On page 9, the Examiner also rejected claim 11 under 35 U.S.C. § 103(a) as being unpatentable over Roeder in view of Chandross. On page 10, the Examiner rejected claims 2, 27, and 41 under 35 U.S.C. § 103(a) as being unpatentable over Roeder in view of Kumar. For the following reasons, the Applicant submits that all pending claims are allowable over the cited references.

Claim 1 is directed to a method for assembling carbon particles into at least one aligned carbon fiber. The method has the step of drawing glass containing said carbon particles so as **to form** at least one **carbon fiber from** said **carbon particles**.

Roeder discloses a method of embedding **already formed** fiber bundles into a glass matrix for the production of a composite material that has improved mechanical characteristics compared to those of unreinforced glass. According to this method, a **prefabricated** (carbon or silicon-carbide) **fiber** bundle is impregnated with glass powder and placed into a hollow mandrel. The tip of the hollow mandrel has a cone-shaped taper with a hole connecting the mandrel to a glass-melt volume. The glass melt is extruded from the volume through a die channel. The glass-impregnated fiber bundle is drawn through the hole in the mandrel into the glass-melt volume and is pushed together with the glass melt through the die channel to form a glass rod or profile having a fiber-reinforced core. (See Roeder's pages 11-13.)

The prefabricated fibers used in the method of Roeder are relatively long fibers spooled on cardboard rolls. At about 600 °C, the sizing that covers the spooled fibers is stripped off and the individual filaments of each fiber are loosened from one another. The fibers thus treated are cut to a suitable length and a relatively large number of the resulting fiber pieces are bundled together to form, after the glass impregnation, the prefabricated fiber bundle, which is then placed into the hollow mandrel. (See Roeder's pages 22-23.)

To impregnate a fiber bundle with glass powder, the fiber bundle is immersed, for approximately 45 seconds, into a suspension of boiling alcohol and glass powder. The boiling of the alcohol swirls and agitates the glass powder to uniformly distribute the glass powder in the liquid. When the fiber bundle is immersed into this boiling suspension, the glass powder infiltrates the fiber bundle. After the fiber bundle is removed from the boiling suspension and the alcohol is evaporated, the glass powder that has infiltrated the fiber bundle adheres to the individual fiber filaments, thereby forming the glass-impregnated fiber bundle. (See Roeder's pages 15 and 23.)

Based on the above characterization of Roeder, the Applicant submits that the method of Roeder differs from the method of claim 1 in at least that, in the former method, glass is drawn to embed into it the **already existing, previously formed** carbon fiber obtained from an external source (e.g., a cardboard spool), whereas in the latter method, glass is drawn to form a carbon fiber from carbon particles contained in the glass, with the fiber being formed as the glass is being drawn.

On pages 11-12 of the office action the Examiner asserts that Roeder's step of compacting the previously loosened filaments of prefabricated fibers in the process of drawing them through the cone-shaped taper of the hollow mandrel is an example of the step of "drawing glass containing said carbon particles so as to form at least one carbon fiber from said carbon particles" recited in claim 1. For the following reasons, the Applicant respectfully disagrees.

First, the Applicant submits that no fiber is being formed from carbon particles in the method of Roeder because, even after the filaments have been loosened, the previously formed carbon fiber does not cease to exist. Although the filaments of a fiber bundle are loosened from each other, neither the individual filaments nor the fibers in the bundle are reverted back to mere particles. Instead, they remain fibers. The fact that the degree of fiber disintegration due to the filament loosening is very slight is made very clear, for example, by the following passages in Roeder. The fibers composed of loosened filaments can still be cut to a suitable length and combined into bundles (see Roeder's page 23). The glass powder used in the impregnation process has a very fine grain size (less than about 40 μm) and, yet, there is substantially no loss of this glass powder from the impregnated fiber bundle as it is being moved into the hollow mandrel (see Roeder's pages 23-24). If the degree of fiber disintegration were not slight, then it would not be possible to keep the fine glass powder sufficiently entrapped between the filaments to enable the powder to survive, without being shaken off, the process of mechanically moving the glass-impregnated fiber bundles into the hollow mandrel.

Because the degree of fiber disintegration is very slight and the loosened filaments remain fibers, there is no formation of carbon fibers from carbon particles in the method of Roeder, the Examiner's statement to the contrary notwithstanding. This conclusion is reinforced by the fact that Roeder himself describes his method as one in which the fiber is "precompacted," "radially compressed" (page 12), and subjected to "compacting and shaping" (page 15), but never as one in which the fiber is created or formed from carbon particles. In contrast, claim 1 requires that at least one carbon fiber be formed from carbon particles.

Second, even if the "formation" of carbon fiber was present in the method of Roeder, which the Applicant does not admit, the carbon fiber would have been formed **from carbon filaments**, and not from carbon particles as required by claim 1. Although, on page 12 of the office action, the Examiner contends that "carbon filaments" represent an example of "carbon particles," the Applicant respectfully disagrees and submits that such an interpretation of these terms is improper. The reasons for this disagreement are outlined below.

At page 903, Merriam-Webster's Collegiate Dictionary defines a particle as "a minute quantity or fragment" or "a relatively small or the smallest discrete portion or amount of something" (see the Eleventh Edition, Merriam-Webster, Inc., Springfield, Massachusetts, 2003). At page 467, the Dictionary further defines a filament as "a single thread or a thin flexible threadlike object, process, or appendage." At page 464, the Dictionary further defines a fiber as "a thread or a structure or object resembling a thread: ... a slender and greatly elongated natural or synthetic filament (as of wool, cotton, asbestos, gold, glass, or rayon) typically capable of being spun into yarn." Based on these definitions, it is submitted that there is a significant difference between a "particle" and a "filament." One representative line of distinction between a "particle" and a "filament" can be drawn based on size. For example, it is clear that Roeder's carbon filaments are relatively large objects that can be mechanically grabbed and piled into bundles. In contrast, Applicant's specification makes it clear that "carbon particles" are relatively small objects that, for example, can be dispersed in a glass body to form a sol-gel solution (see page 4, lines 8-19). Clearly, Roeder's filaments are too large to form a sol-gel solution and, as such, cannot serve as an

example of carbon particles recited in claim 1, the Examiner's assertion to the contrary notwithstanding.

For at least these reasons, the Applicant submits that the Examiner misinterpreted the teachings of Roeder and used them improperly to reject claim 1. It is therefore submitted that claim 1 is allowable over Roeder and its rejection over Roeder should be withdrawn. For a similar reason, it is submitted that claims 26 and 40 are allowable over Roeder. Since the rest of the claims depend variously from claims 1, 26, and 40, it is further submitted that those claims are allowable over Roeder and the cited reference combinations that include Roeder. The Applicant submits therefore that the rejections of claims under §§ 102 and 103 have been overcome.

Claim 45, which depends from claim 1, further specifies that the method has the steps of: (A) dispersing said carbon particles within a form of liquid glass to form a sol-gel solution; and (B) solidifying the sol-gel solution to form a glass body containing therein said carbon particles. The step of drawing recited in claim 1 comprises: (C) drawing said glass body into the at least one carbon fiber. Claims 42 and 47, which depend from claims 40 and 26, respectively, have similar limitations.

In the rejection of claim 45, on page 5 of the office action, in reference to Roeder, the Examiner stated that:

> This sol-gel impregnation process is implicitly understood to encompass Applicants claimed step of dispersing the carbon particles in a sol-gel solution (claim 42, 45) and "solidifying" at least a portion of the sol-gel solution to "form a glass body containing therein said carbon particles."

In response, the Applicant submits that this characterization of Roeder is unfounded and improper.

First of all, claim 45 recites the step of **dispersing carbon particles** within a form of liquid glass to form a sol-gel solution. The term "dispersing" means distributing more or less evenly throughout a medium (see, for example, Merriam-Webster's Collegiate Dictionary, Eleventh Edition, Merriam-Webster, Inc., Springfield, Massachusetts, 2003, p. 361). In the method of Roeder, **glass particles**, not carbon particles, **are being dispersed** in alcohol, whereas the fibers of the fiber bundle remain structurally intact and are not being dispersed in any manner at all. In addition, claim 45 recites the step of **solidifying** the sol-gel solution to form a glass body containing therein said carbon particles. Solidifying a substance means making that substance solid or hard (see, for example, Merriam-Webster's Collegiate Dictionary, Eleventh Edition, Merriam-Webster, Inc., Springfield, Massachusetts, 2003, p. 1187). In the method of Roeder, the already solid glass particles of the glass/alcohol suspension adhere to the already solid fiber bundle. Thus, in the method of Roeder, **one solid** is simply **aggregated with another solid**. When the two aggregated solids are heated up and drawn through the hole in the mandrel there is no sol-gel solution at that point at least because the solvent has already been removed. Although it is true that the heat melts the solid glass particles in the bundle, this melting does not create a sol-gel solution or mixture that can be subsequently solidified to form a glass body to be drawn as required by claim 45.

The Applicant submits that none of the other references can rectify the deficiencies of Roeder with respect to claim 45. More specifically, Zhang discloses spinning of multi-walled carbon nanotubes into torque-stabilized carbon-nanotube yarns. Kumar discloses synthesis of poly-p-phenylene benzobisoxazole (PBO) in the presence of carbon nanotubes to produce carbon-nanotube-containing polymer composites. Chandross discloses casting relatively large, crack-free silica bodies from a sol of colloidal silica in water. The Applicant submits that the cited references, independently or in combination, do not teach or suggest at least the steps of (A) dispersing carbon

particles within a form of liquid glass to form a sol-gel solution and (B) solidifying the sol-gel solution to form a glass body containing therein said carbon particles.

All these facts provide additional reasons for the allowability of claim 45 over the cited references. At least some of these reasons similarly apply to the allowability of claims 42 and 47 over the cited references.

With respect to claim 10, the Applicant specifically notes that the Examiner's rejection of that claim is improper and should be withdrawn. In particular, claim 10 and its base claims recite the steps of (a) solidifying a mixture of carbon particles within a sol-gel solution whereby a body is formed and (b) dispersing carbon particles within said sol-gel solution to form said mixture. For at least some of the reasons already explained above in reference to claim 45, the Applicant submits that Roeder does not teach or even suggest such steps. It therefore follows that the Examiner misinterpreted the teachings of Roeder and used them improperly to reject previously presented claim 10.

In view of the above remarks and arguments, the Applicant believes that the pending claims are in condition for allowance. Therefore, the Applicant believes that the entire application is now in condition for allowance, and early and favorable action is respectfully solicited.

Respectfully submitted,

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